



Nanomaterials Research at the Molecular Foundry

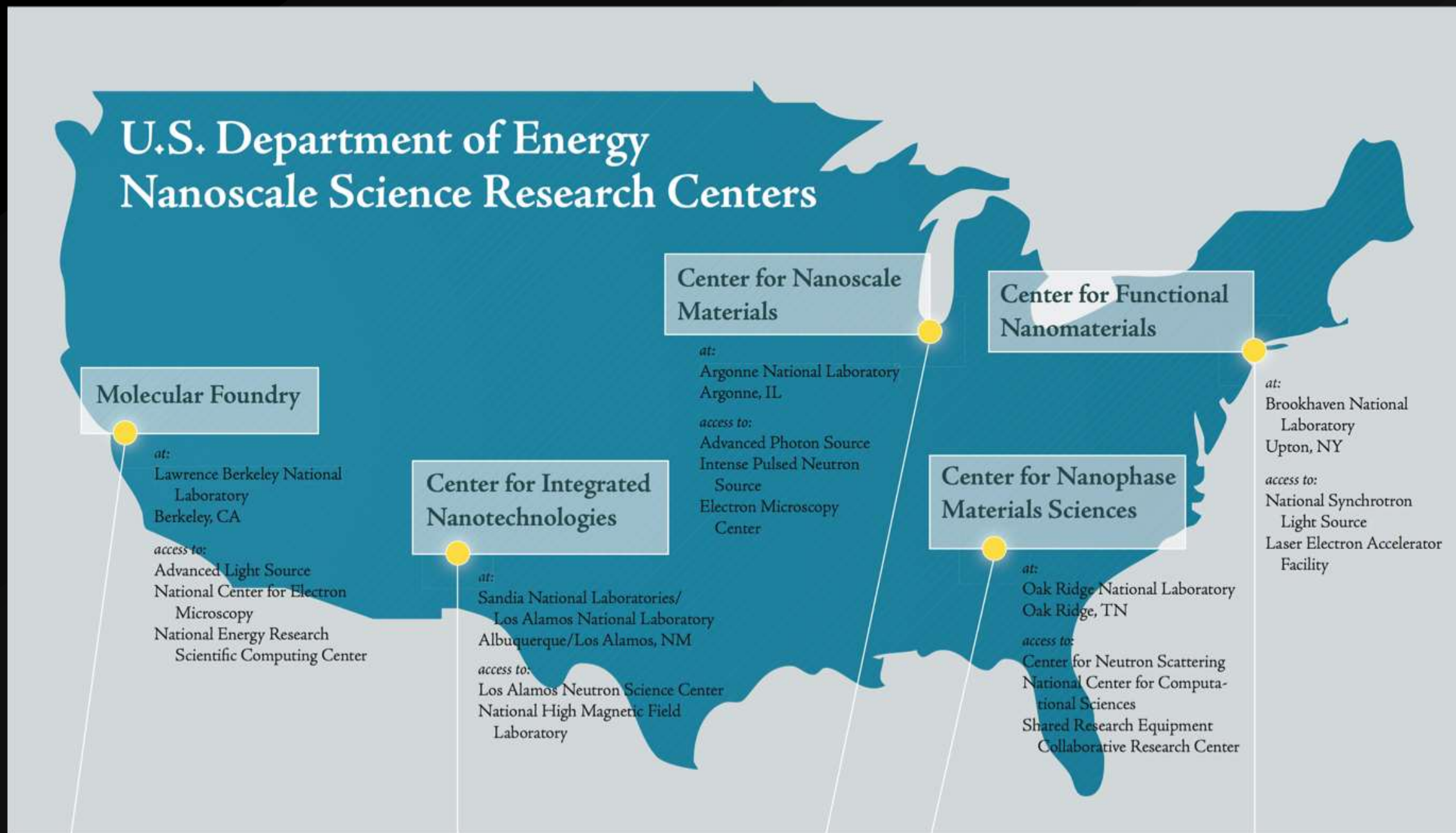
Delia Milliron

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Lawrence Berkeley National Lab

Community Advisory Group
March 16, 2012

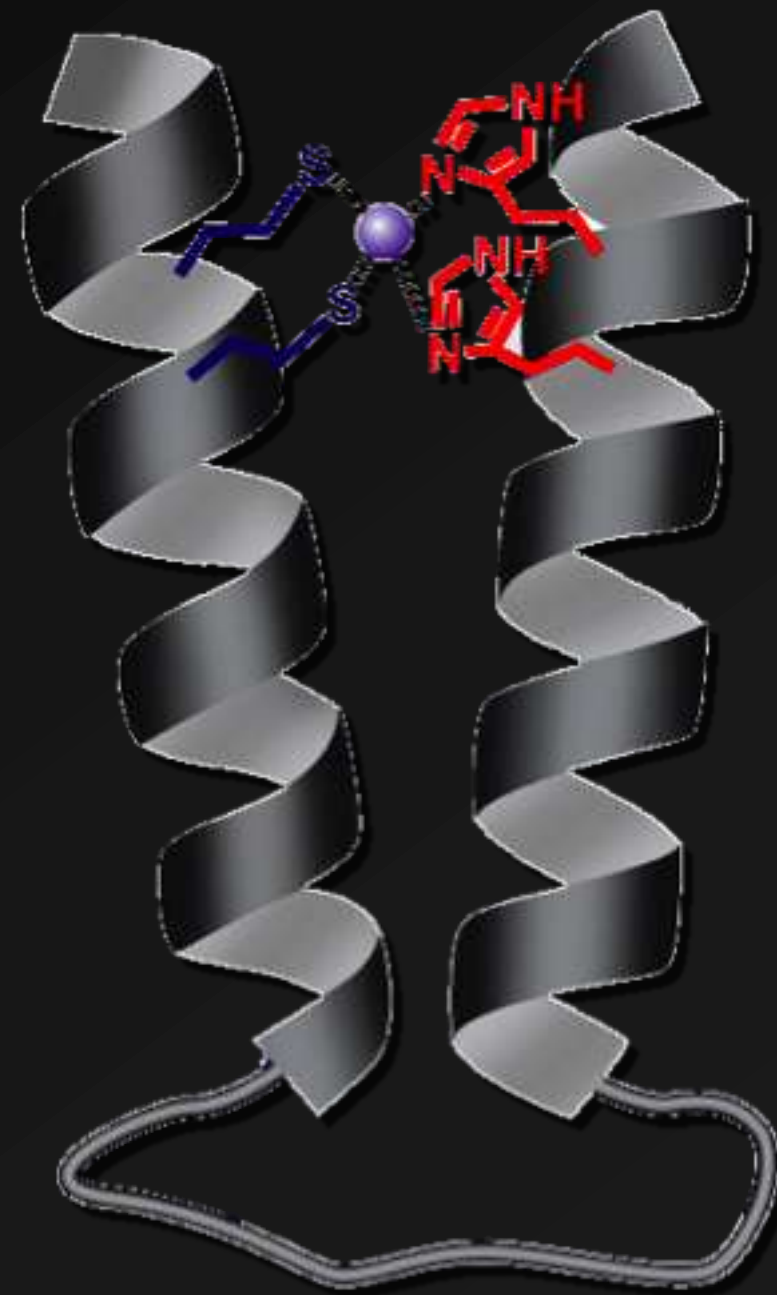
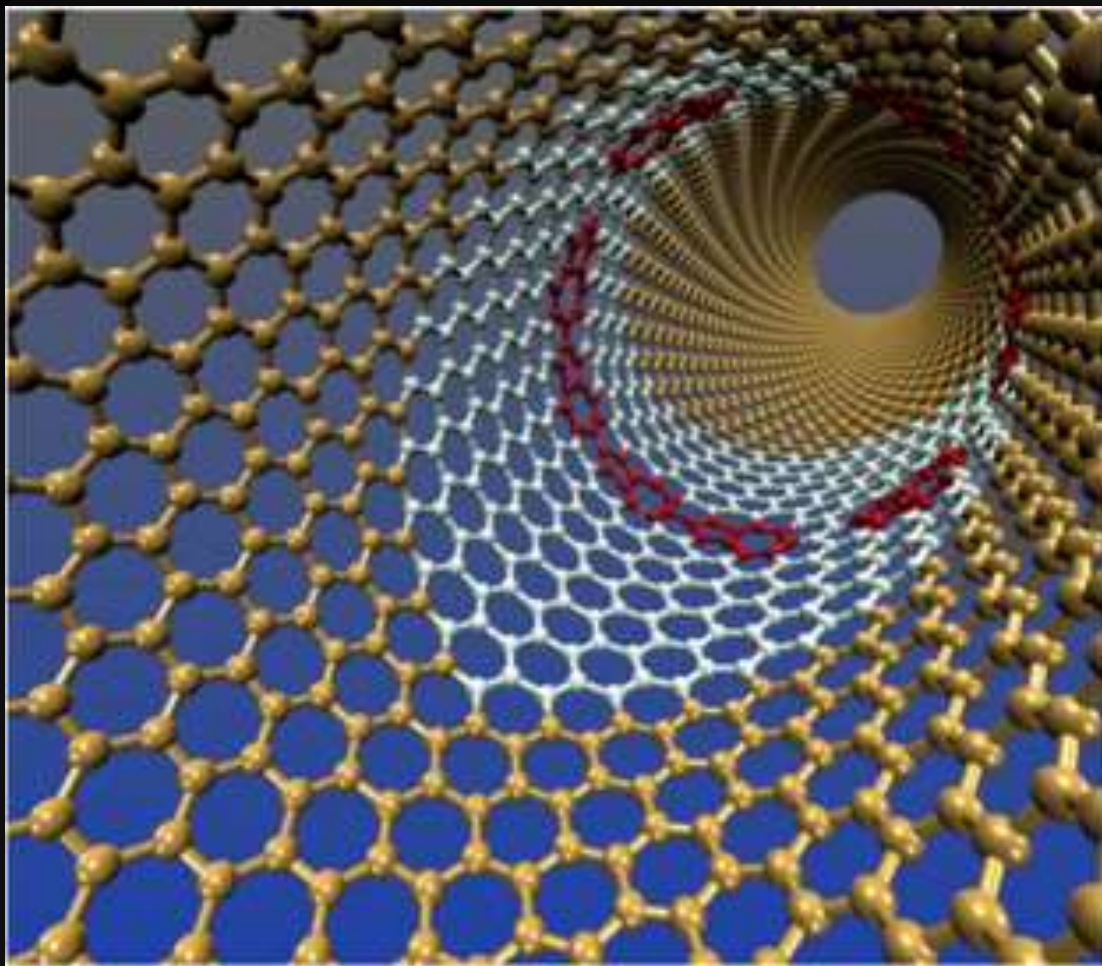


Working at the Molecular Foundry



Working at the Molecular Foundry

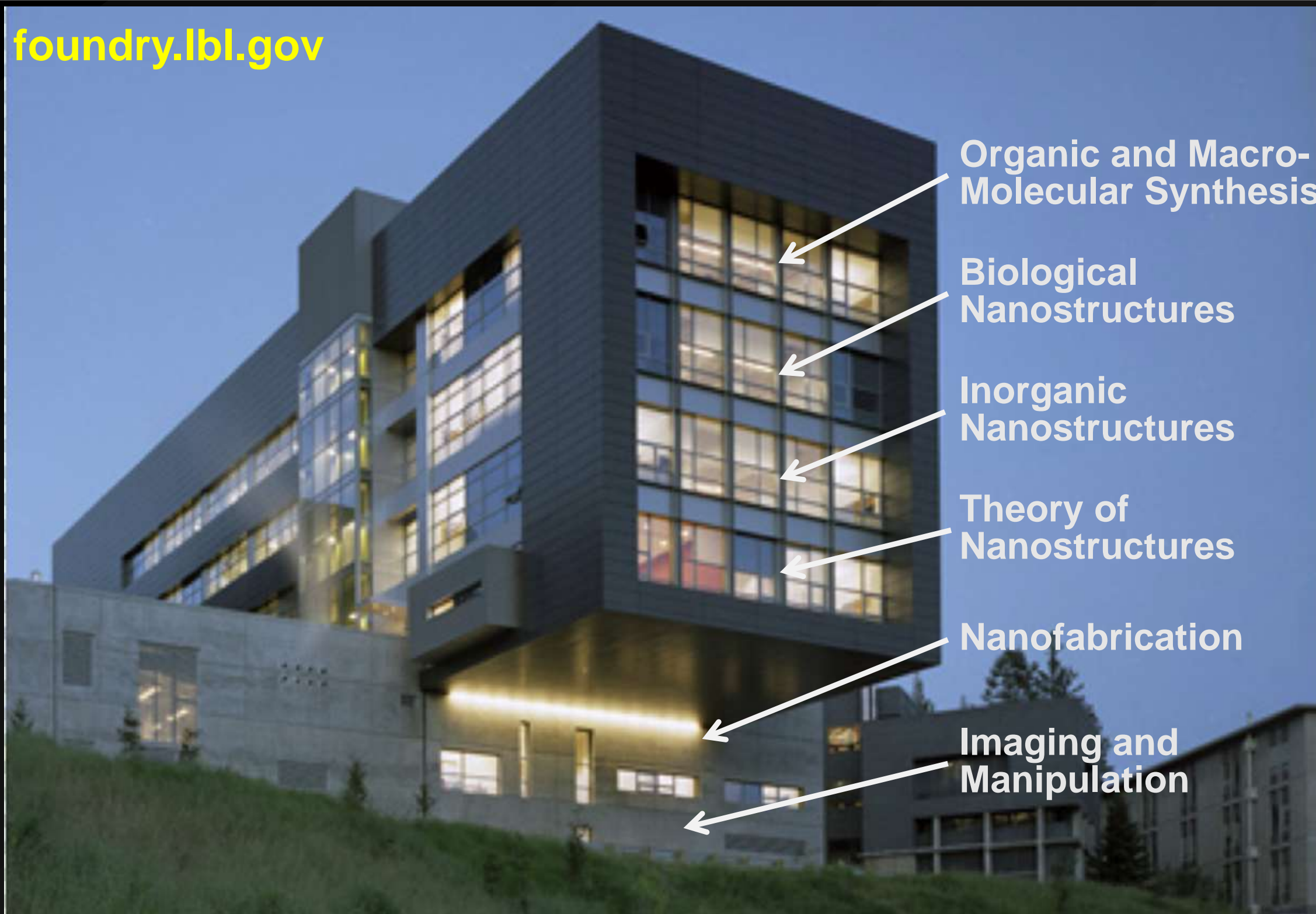


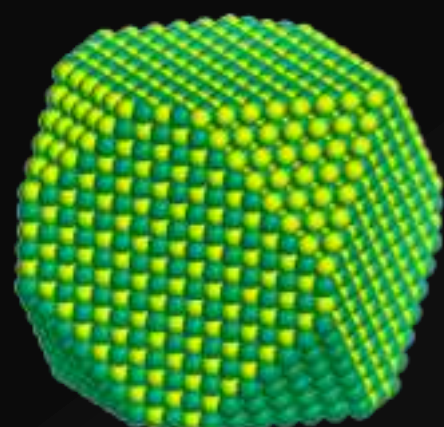




The Molecular Foundry is a multi-disciplinary user facility for nanoscience

foundry.lbl.gov

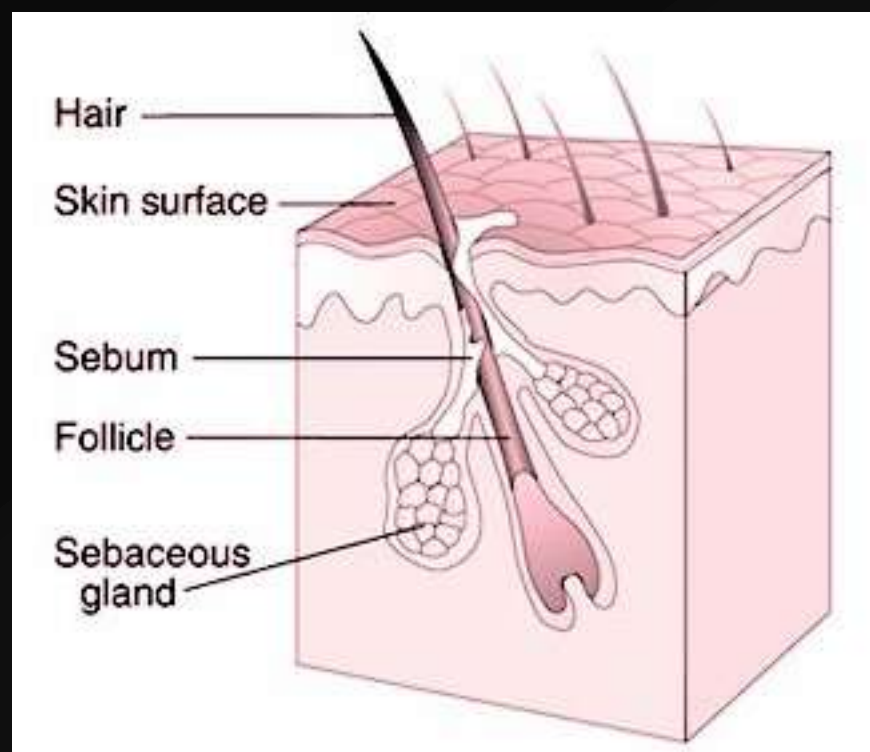




x 20,000

***5 nm
5000 atoms***

x one million



Gold



Nano Gold



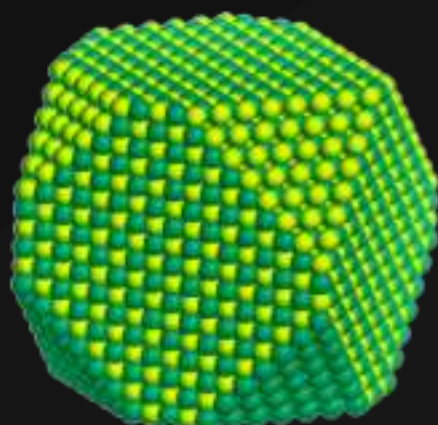
Size-dependent light emission from semiconductor nanocrystals (quantum dots)



size

1.7 nm
600 atoms

6 nm
6000 atoms



Couch >> puppy
Low energy state



Puppy >> couch
High energy state

increasing confinement

Making nanocrystals by using robots to do chemistry





Using robots to do chemistry (video)

<http://www.youtube.com/watch?v=I22En9JOj3A>



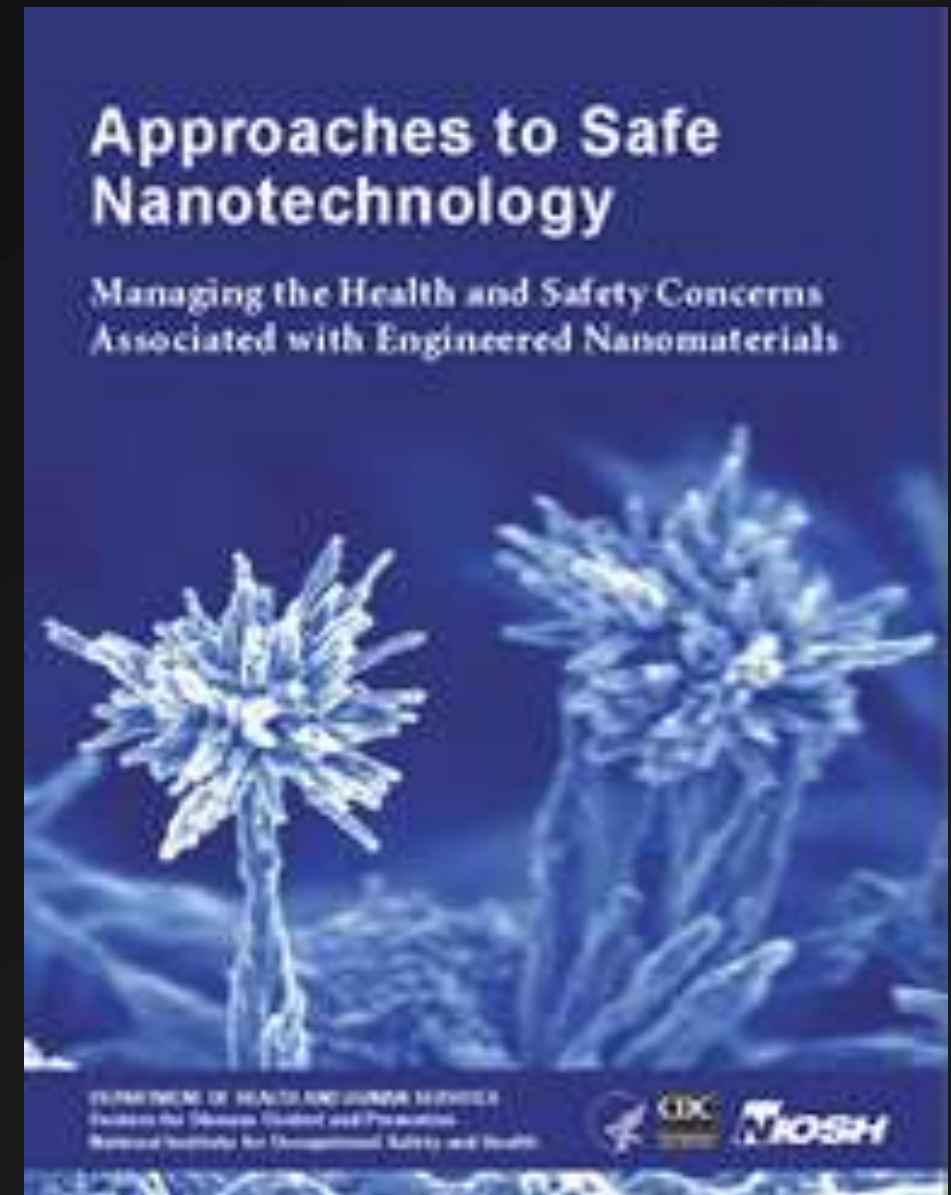
Integrating safety into science

What is different about a nanomaterial from its bigger form?

What happens to nanomaterials in the environment?

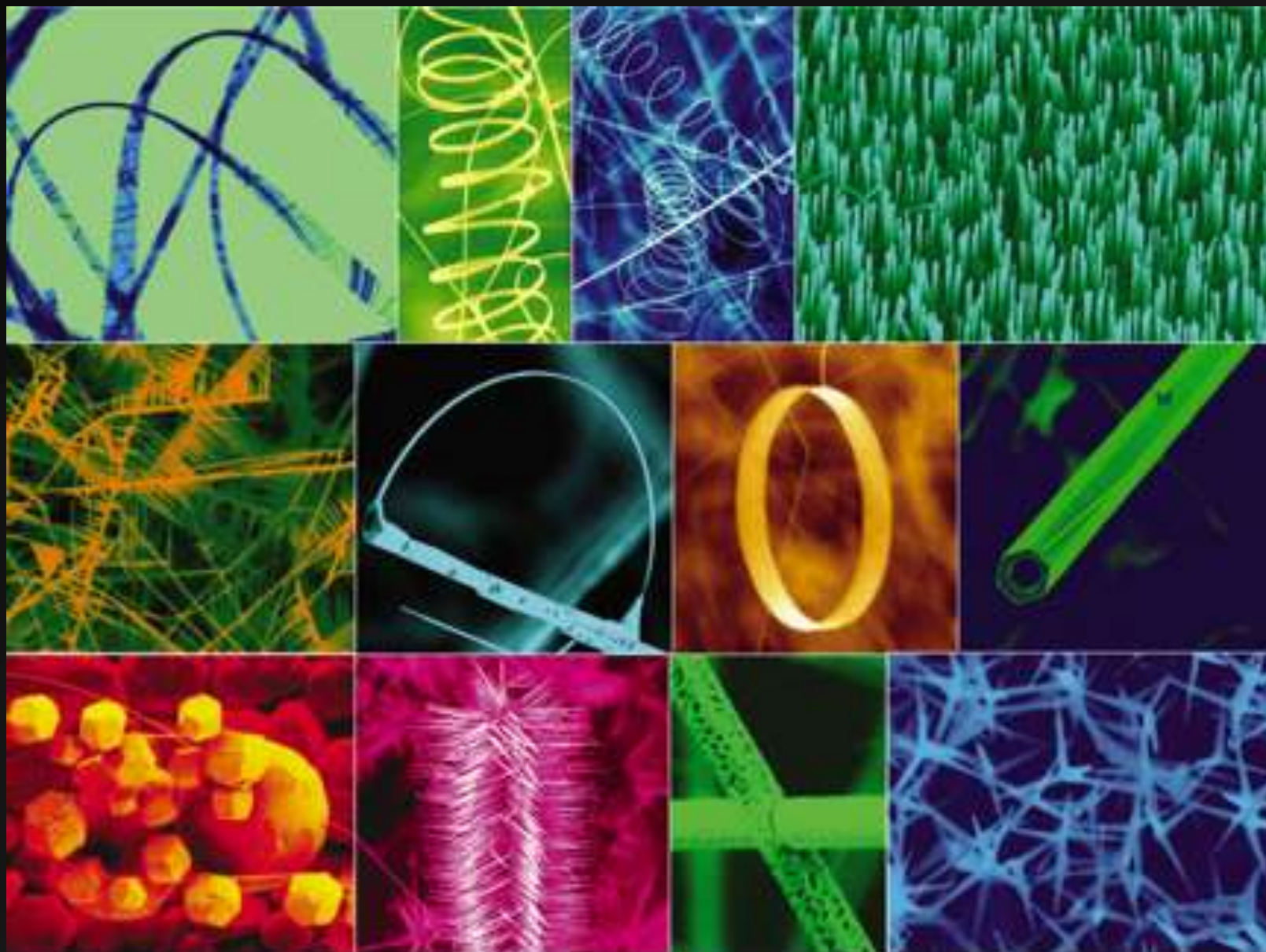
Are there safety issues for workers involved in making or researching nanomaterials?

Do we have the right tools to manage these materials properly?



One chemistry, many forms

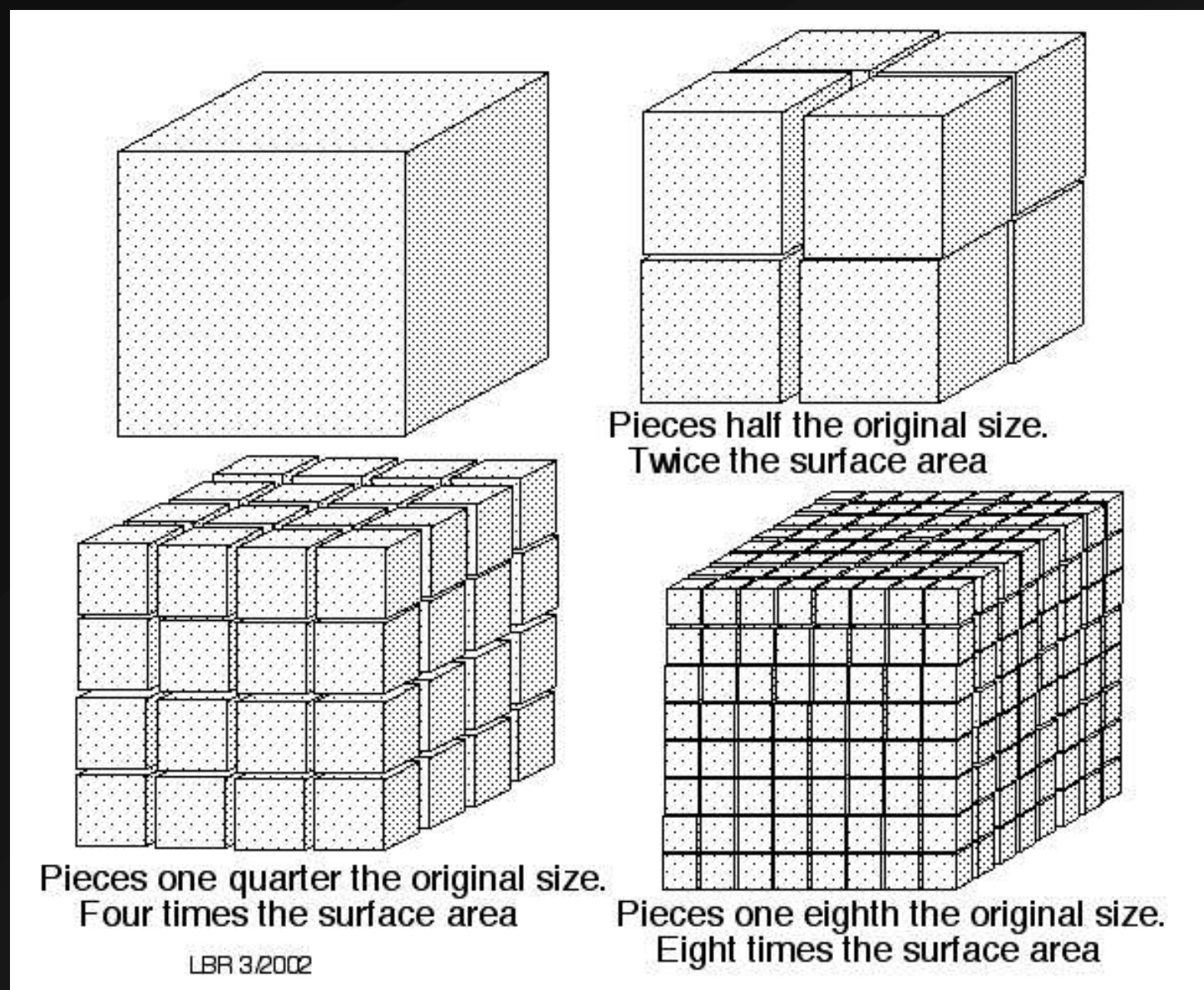
Size
Shape
Chemistry
Crystal structure
Water solubility
Surface area
Surface coating
Agglomeration state
Density
Dispersibility
Porosity
Surface charge
Conductivity
Contaminants
Manufacturing method



One material: ZnO

New properties, different issues

Size
Shape
Chemistry
Crystal structure
Water solubility
Surface area
Surface coating
Agglomeration state
Density
Dispersibility
Porosity
Surface charge
Conductivity
Contaminants
Manufacturing method



***More surface area
= more reactivity***

DOE policy on nanotechnology

DOE Order 456.1

- Constantly monitor the toxicological literature and safety guidance documents for new developments
- Keep a record of researchers potentially exposed
- Establish engineered nanoparticles safety policy and provide training
- Minimize researcher exposure to engineered nanoparticles
- Post warning signs, label containers of engineered nanoparticles
- Manage waste carefully



Foundry safety philosophy and approach



Fume hoods and glovebox environments





Special safety training for engineered nanoparticles





Proactive nanoparticle safety training and outreach efforts


**BERKELEY LAB**
LAWRENCE BERKELEY NATIONAL LABORATORY

U.S. DEPARTMENT OF
ENERGY

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The Materials Sciences Division

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**EH&S Challenges of the Nanotechnology Revolution Symposium 2009**
Sponsored by Center for Occupational & Environmental Health, University of California, Berkeley

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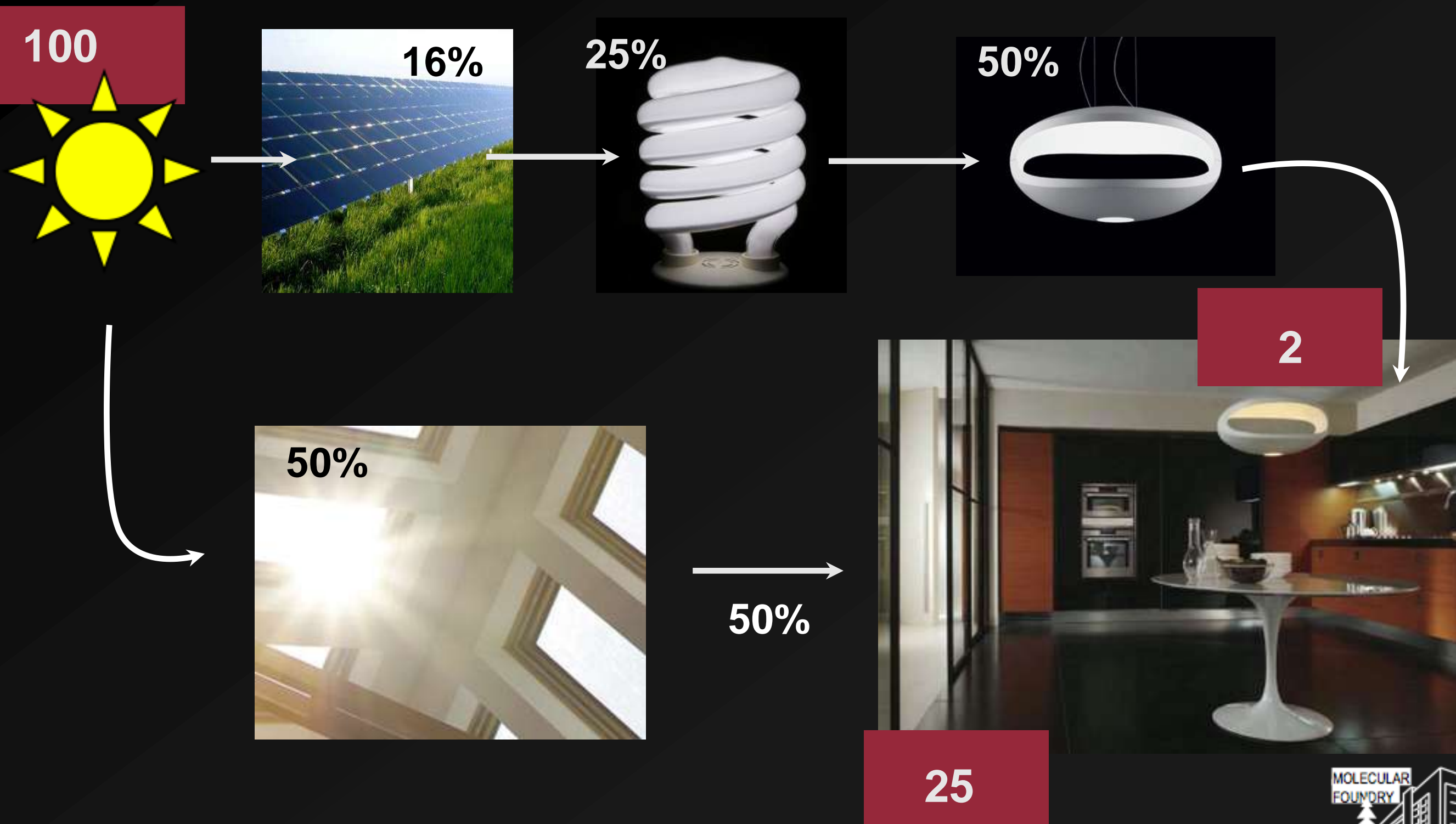


Sponsor symposia to train health and safety professionals, physicians, community members

Special detection techniques: zero-background nanoparticle aerosol measurement glovebox



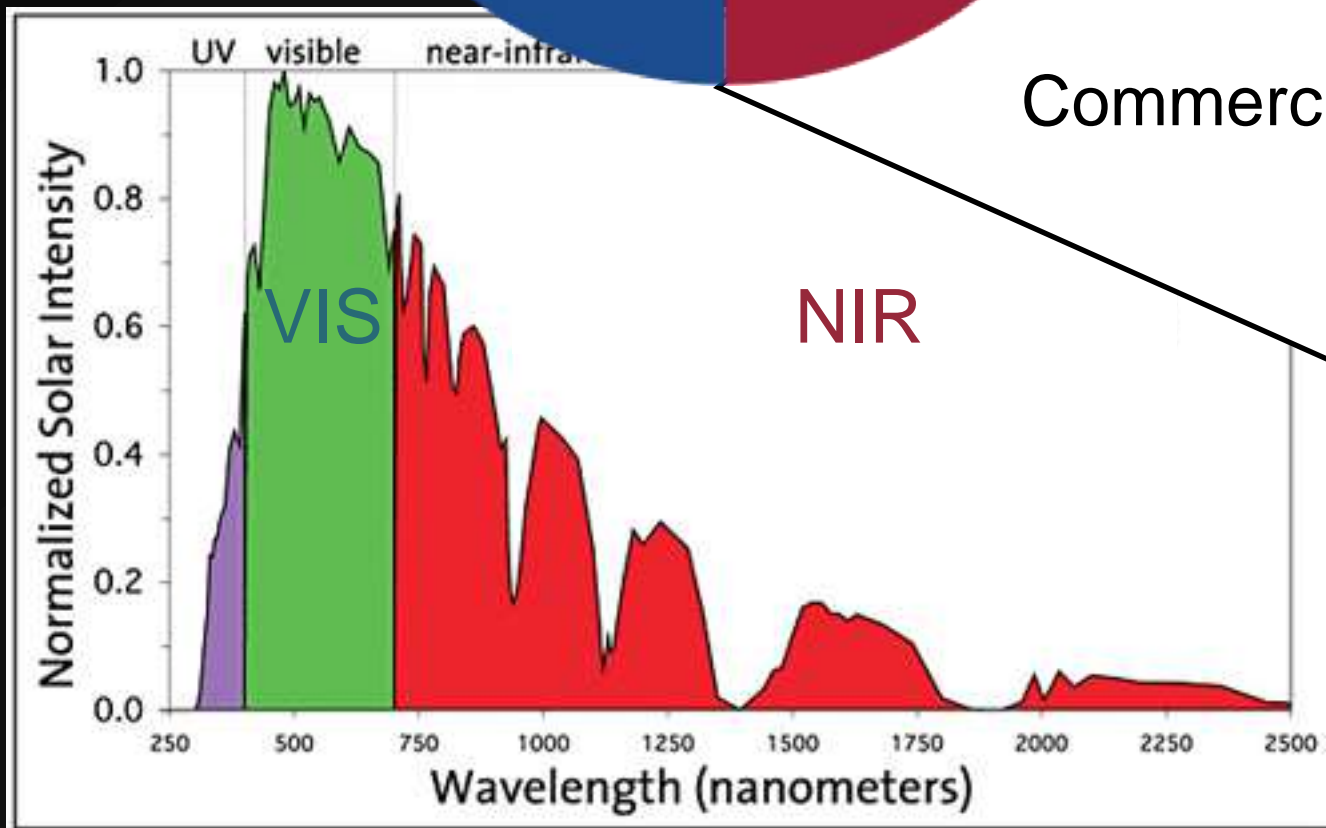
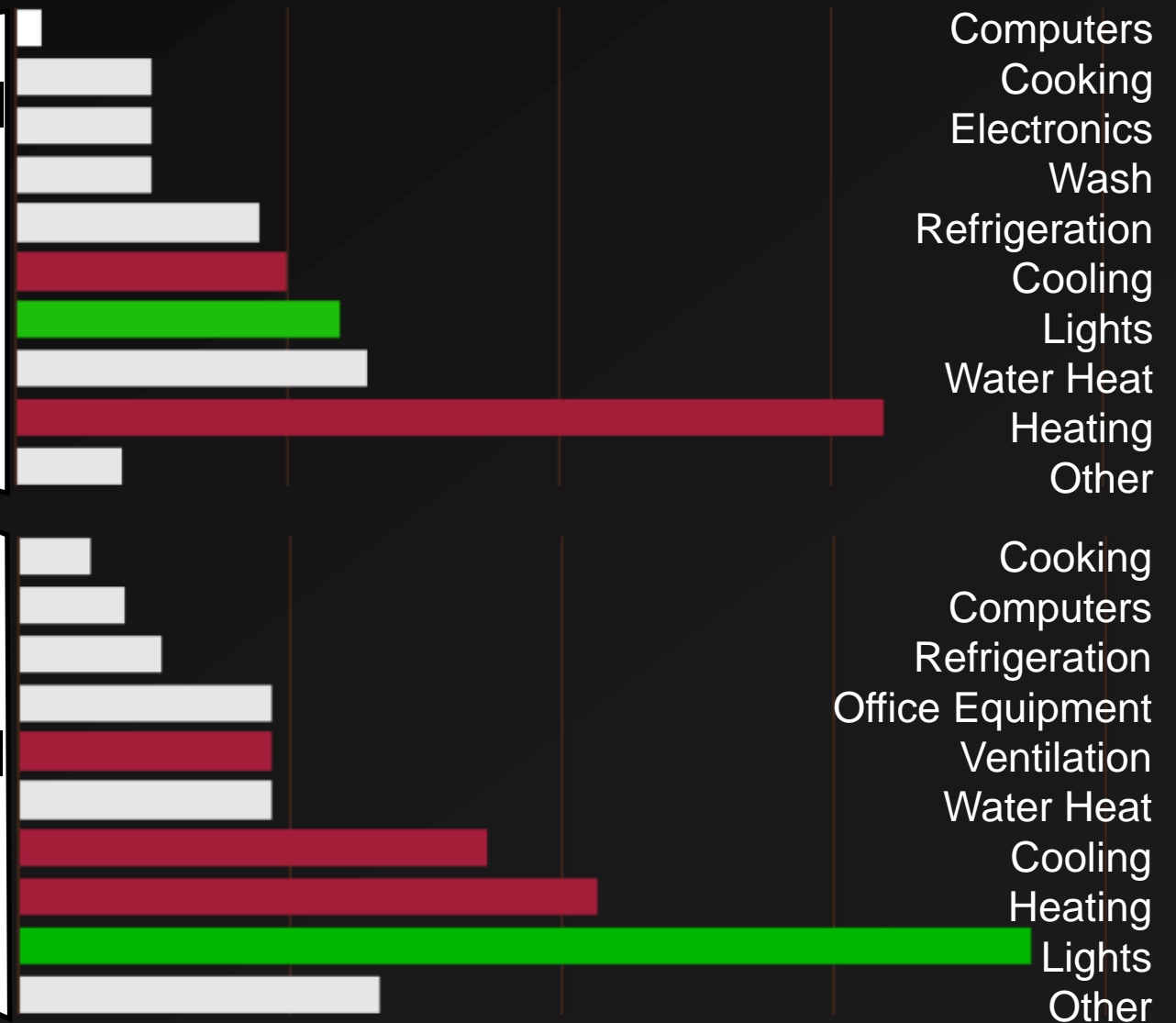
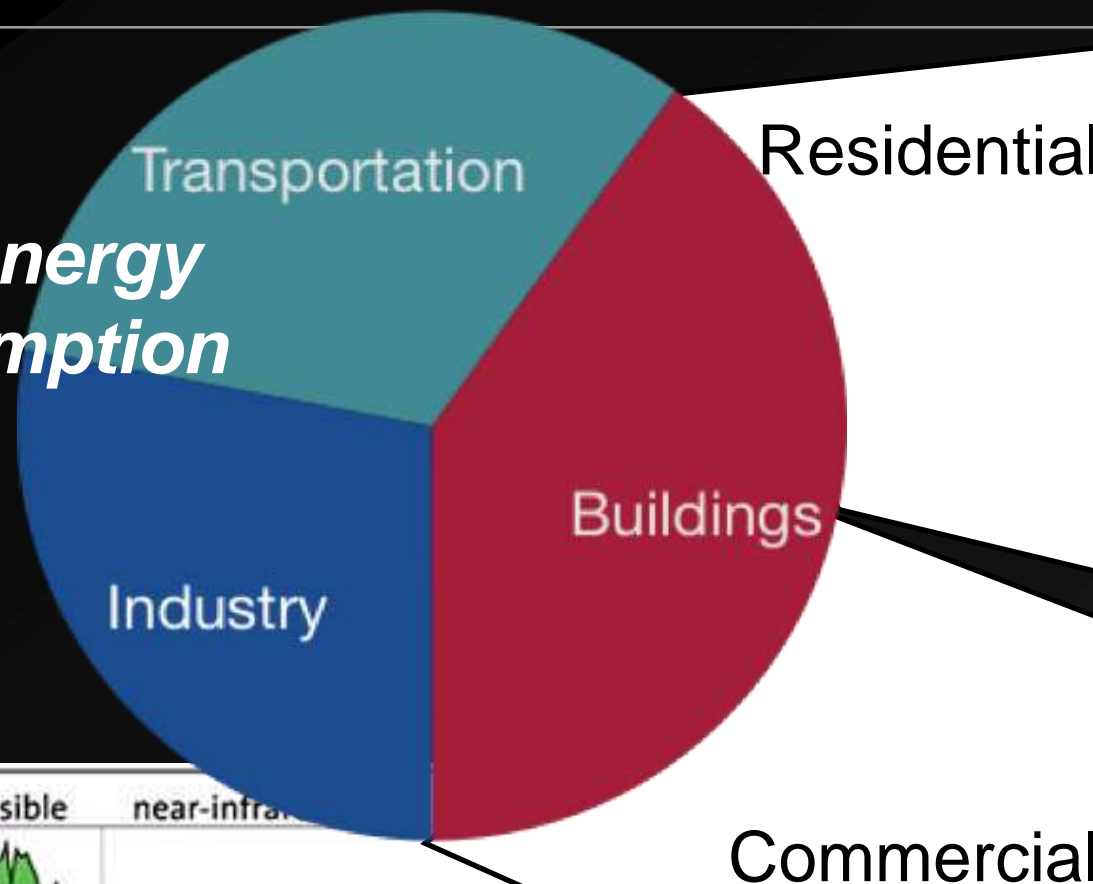
Using sunlight effectively: Electric Conversion vs. Direct Use





Motivation for dynamic infrared window coatings: Lighting and thermal management

***U.S. energy
consumption***

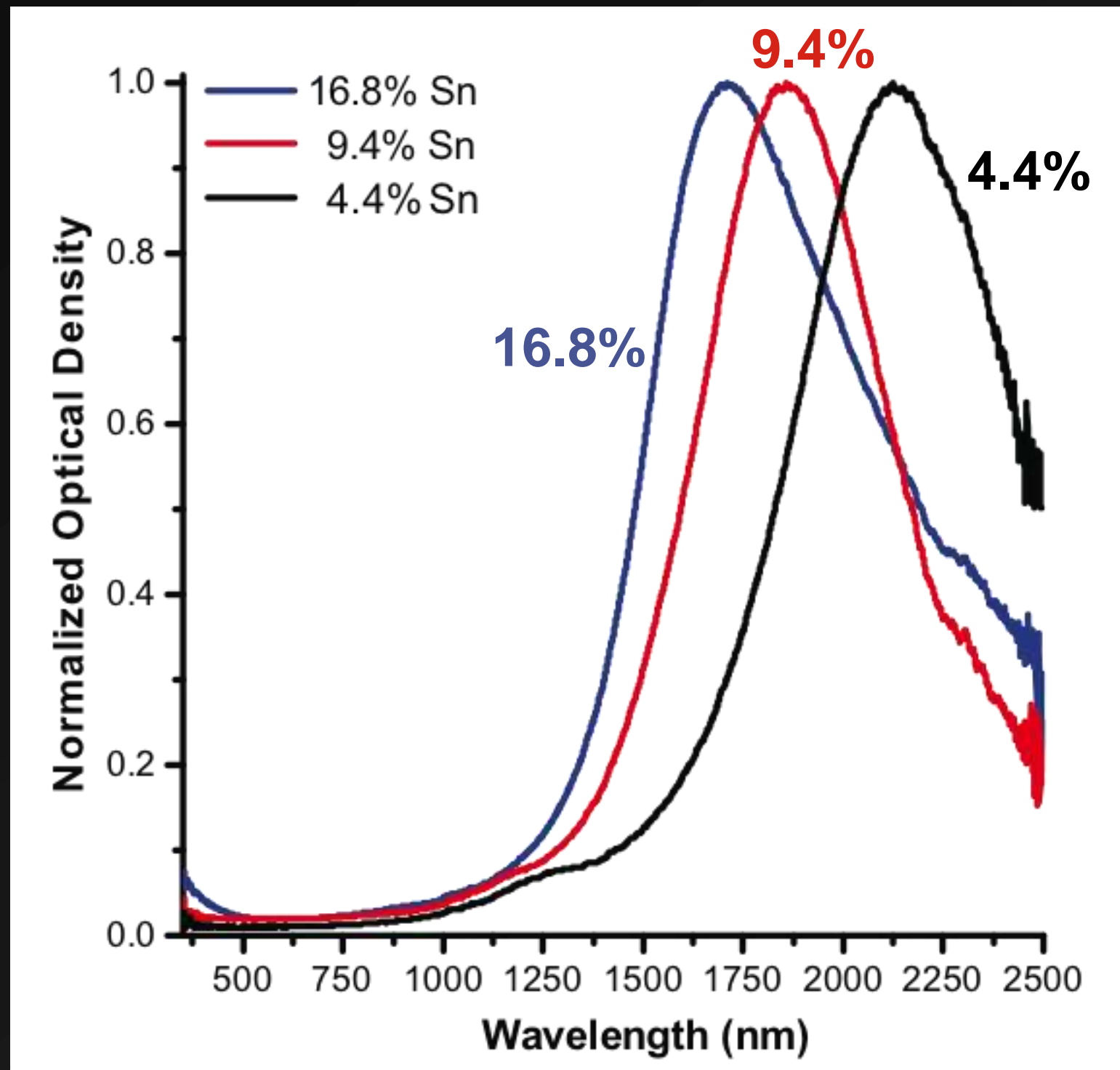
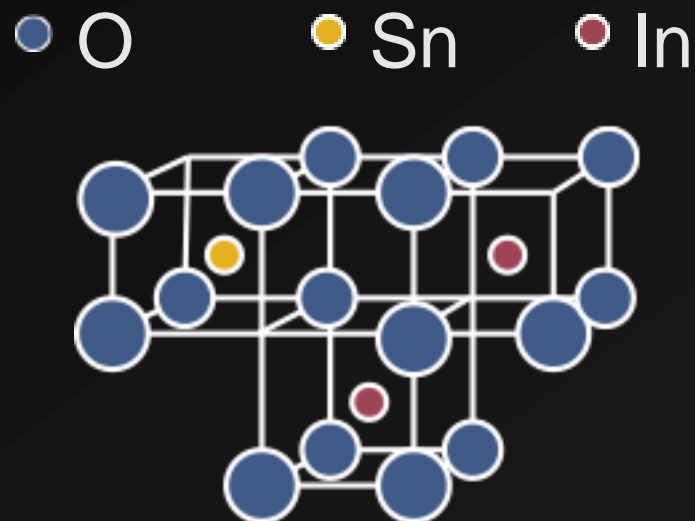


Solar Energy

- **Visible:** use for lighting
- **NIR:** use for heating

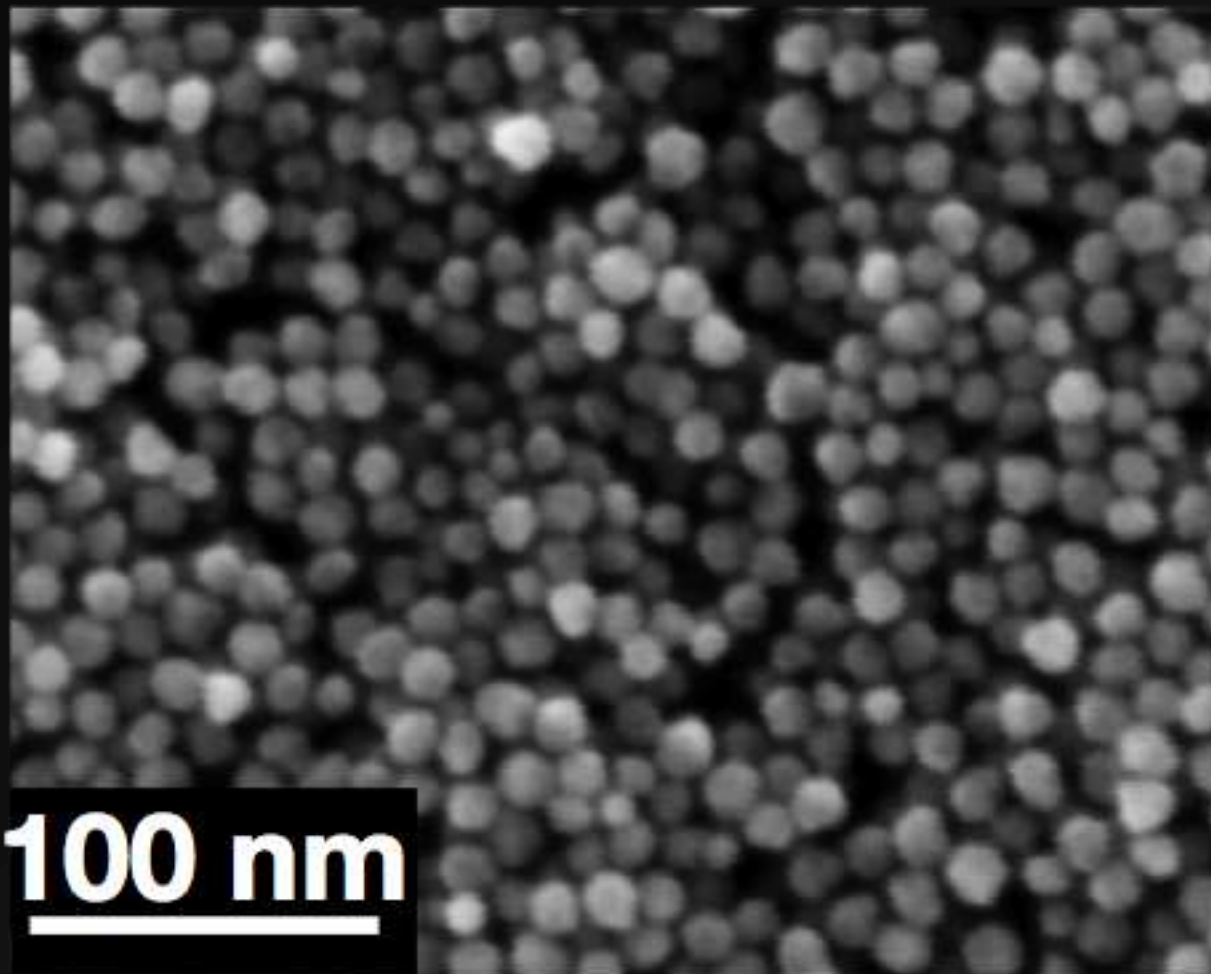


Transparent nanocrystals that absorb infrared radiation from the sun

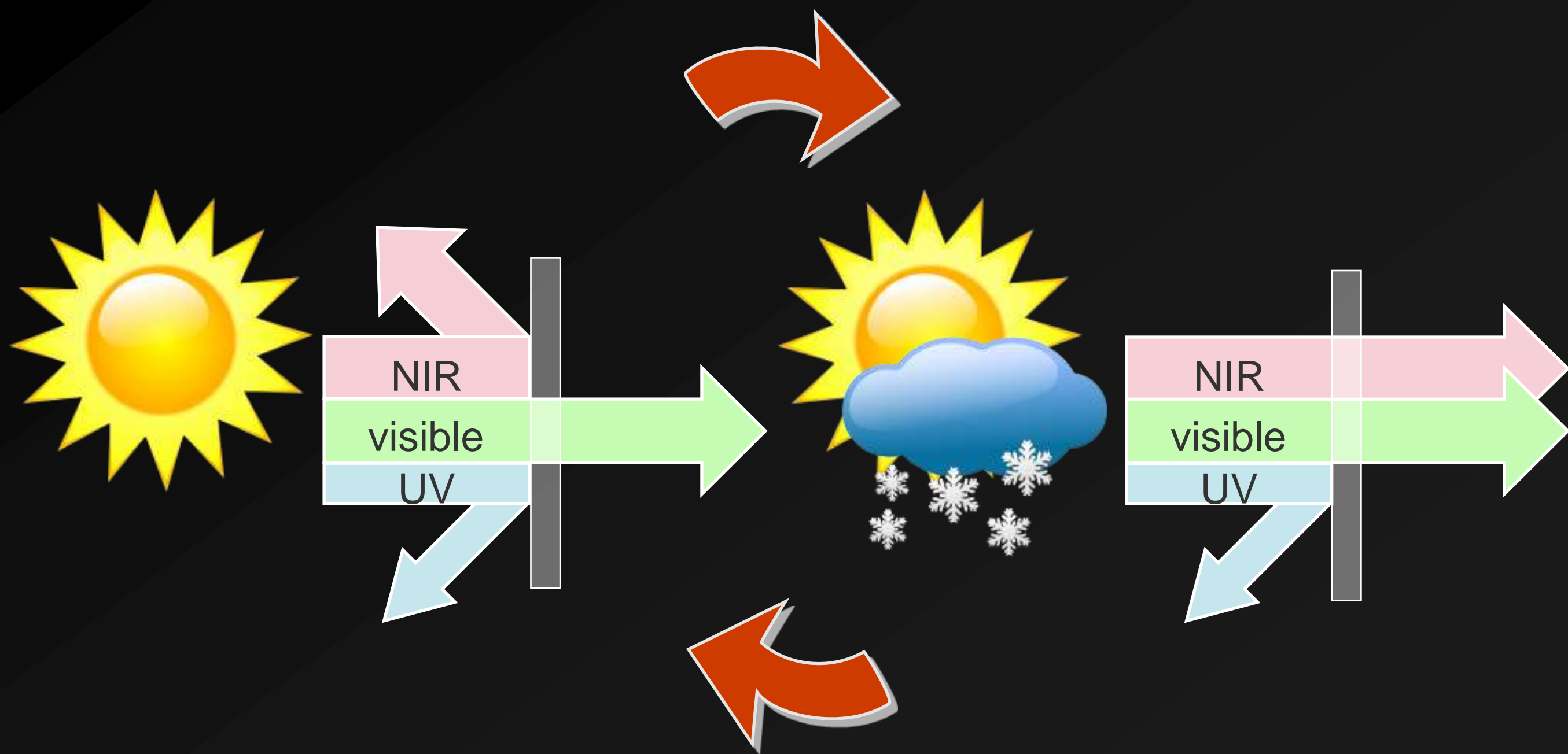




Nanocrystal window coating



A nanocrystal-powered smart window



Thank you!

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